
टार और बिटुमन सामग्रियों के लिए परीक्षण
पद्धतियाँ — जल-अवयव
ज्ञात करना — डीन और स्टार्क पद्धति
(दूसरा पुनरीक्षण)

Methods for Testing Tar and
Bituminous Materials —
Determination of Water Content —
Dean and Stark Method
(Second Revision)

ICS 75.140

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FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards after the draft finalized by the Bitumen, Tar and Related Products Sectional Committee, had been approved by the Petroleum, Coal and Related Product Division Council.

This standard was originally published in 1978 as ‘Methods for testing tar and bituminous materials — Determination of water content (Dean and Stark method) and first revised in 1978’. ‘Methods for testing tar and bituminous materials’ was originally published as series of 22 standards in the form of a booklet, as listed below:

<i>IS No.</i>	<i>Title</i>
IS 1201 : 2004	Sampling
IS 1202 : 1978	Determination of specific gravity
IS 1203 : 1978	Determination of penetration
IS 1204 : 1978	Determination of residue of specified penetration
IS 1205 : 1978	Determination of softening point
IS 1206 (Part 1) : 1978	Determination of viscosity: Part 1 Industrial viscosity
IS 1206 (Part 2) : 1978	Determination of viscosity: Part 2 Absolute viscosity
IS 1206 (Part 3) : 1978	Determination of viscosity: Part 3 Kinematic viscosity
IS 1207 : 1978	Determination of equiviscous temperature (EVT)
IS 1208 : 1978	Determination of ductility
IS 1209 : 1978	Determination of flash point and fire point
IS 1210 : 1978	Float test
IS 1211 : 1978	Determination of water content — Dean and stark method
IS 1212 : 1978	Determination of loss on heating
IS 1213 : 1978	Distillation test
IS 1214 : 1978	Determination of matter insoluble in benzene (<i>withdrawn</i> due to toxic nature of benzene)
IS 1215 : 1978	Determination of matter insoluble in toluene
IS 1216 : 1978	Determination of solubility in carbon disulphide trichloroethylene
IS 1217 : 1978	Determination of mineral matter ash
IS 1218 : 1978	Determination of phenols
IS 1219 : 1978	Determination of naphthalene
IS 1220 : 1978	Determination of volatile matter content

However, the Committee responsible for the formulation of standards in the field of bitumen, tar and related products decided to publish these Indian standards separately for each test so as to make it user friendly.

Accordingly, second revision of the standard, IS 1211 ‘Methods for testing tar and bituminous materials — Determination of water content (dean and stark method)’ has been taken up to formulate individual standard.

In this revision all the amendments issued earlier have been incorporated and only use of Electric heater is recommended for heating.

The Composition of the Committee responsible for formulation of this standard is given at Annex A.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’.

Indian Standard

METHODS FOR TESTING TAR AND BITUMINOUS MATERIALS — DETERMINATION OF WATER CONTENT — DEAN AND STARK METHOD

(*Second Revision*)

1 SCOPE

This Standard covers the method for the determination of water content of asphalt bitumen and fluxed native asphalt, crude coal tar, road tar, cutback bitumen, Digboi type cutback bitumen and creosote and anthracene oil.

2 REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions of this draft standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
334 : 2002	Glossary of terms relating to bitumen and tar (<i>third revision</i>)
460 (Part 1) : 2020	Test sieves — Specification: Part 1 Wire cloth test sieves (<i>fourth revision</i>)

3 TERMINOLOGY

3.1 For the purpose of this standard, the following definition and those given in IS 334 shall apply

3.2 Water Content — The quantity of water present in the material expressed as a percentage by mass of the material.

4 APPARATUS AND MATERIAL

4.1 Flask — 500 ml capacity (*see* Fig 1), made of heat resistant glass, well annealed and as free as possible from striae and similar defects. The top of the neck shall be ground to form the socket of a ground glass joint.

4.1.1 A metal flask may be used.

4.2 Condenser — Made of heat resistant glass, well annealed and as free as possible from striae and similar

defects, with shape, dimensions and tolerances shown in Fig. 2.

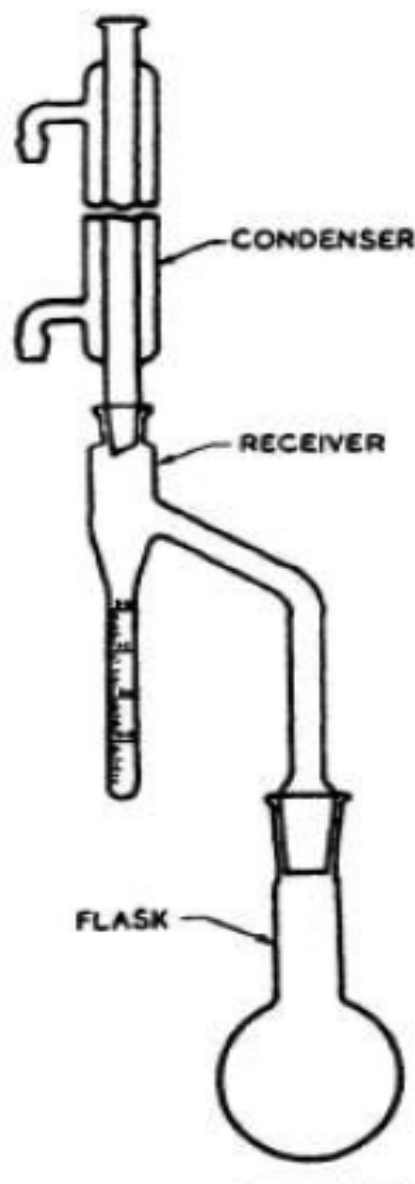


FIG. 1 DEAN AND STARK ASSEMBLY

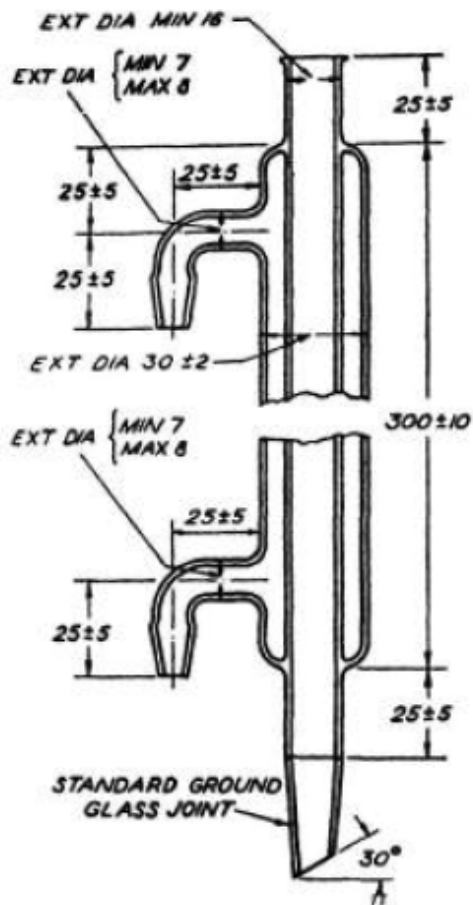


FIG. 2 CONDENSER

4.3 Receiver — Made of heat resistant glass, well annealed and as free as possible from striae and similar defects, provided with ground glass joints with the dimensions and tolerances as given in Table 1 consisting essentially of the upper chamber, side tube with ground glass joint leading to the flask and the graduated tube. Numbered graduation marks shall be carried right round the receiver tube.

The graduation marks midway between the numbered marks be carried about half way round the tube and the other marks shall be intermediate in length and shall project equally at each end beyond the shortest graduation marks.

4.3.1 When a metal flask is used, the receiver of the type shown in Fig. 3 and Fig. 4 without the ground glass

joint shall be used and care shall be taken to provide an air-tight connection between the flask and the receiver.

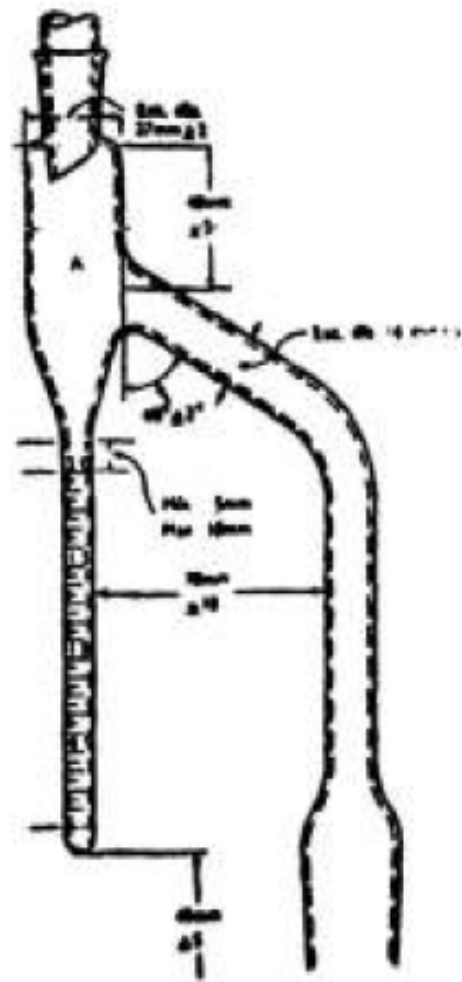


FIG. 3 2-ml RECEIVER (DEAN AND STARK APPARATUS)

4.4 A 100 ml graduated cylinder.

4.5 Heater — Electric heater must be used.

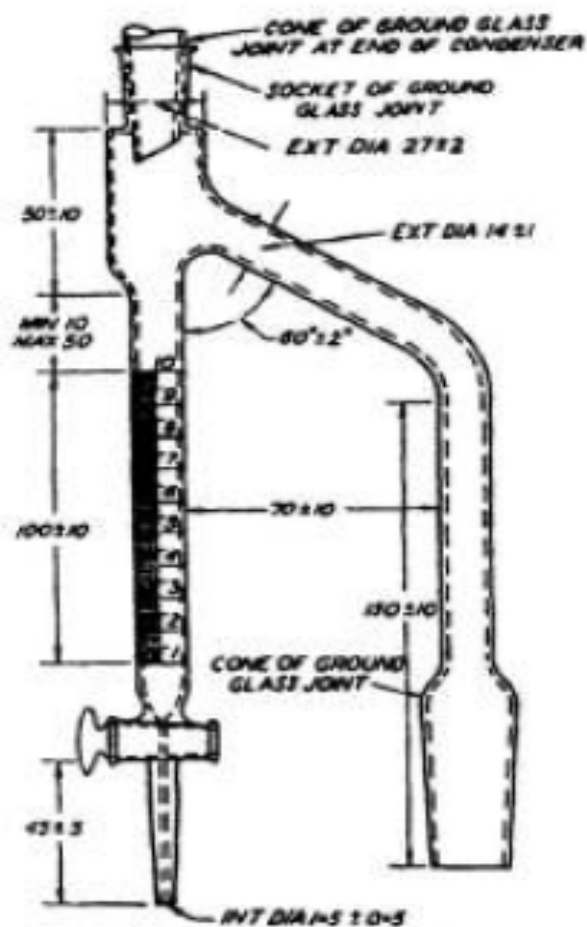
4.6 Solvent — Carrier liquid shall be any one of the following.

4.6.1 Blend of 20 percent by volume of industrial grade toluene and 80 percent by volume of industrial xylene.

4.6.2 Petroleum spirit with a boiling range of 100 to 120 °C.

Table 1 Details of Receivers
(Clause 4.3)

Capacity of Receiver in ml at 20 °C	Graduation Interval ml	Numbering a Every Graduation	Maximum Error ml	Ref to
2	0.1 to 2 in 0.05	0.5 ml	+/- 0.02	Fig. 3
10	1 to 10 in 0.1	1 ml	+/- 0.06	Fig. 4



All dimensions in millimetres

FIG. 4 10-ml RECEIVER (DEAN AND STARK APPARATUS)

5 PROCEDURE

5.1 Place about 100 g of the material with accurately weighed, in the flask and add 100 ml of solvent (*see 4.6*). Attach the flask to the dean and stark condensing and collecting system, and heat the flask at such a rate that the condensate falls from the end of the condenser at a rate of two to five drops per second. Continue the distillation until condensed water is no longer visible in any part of the apparatus except the bottom of the graduated tube and until the volume of water collected remains constant for a period not less than five minutes. Remove the persistent ring of condensed water in the condenser tube, if any, by increasing the rate of distillation by a few drops per second. Wash droplets of water which adhere to the lower end of the condenser tube into the receiver with solvent/carrier liquid using the spray tube. Insert a loose plug of cotton wool in the top of the condenser tube to prevent the condensation of atmospheric moisture in the condenser tube.

6 REPORT

Report the results as water content to the nearest 0.05 percent by weight if 2 ml receiver has been used and to the nearest 0.1 percent if the 10 ml receiver has been used with 100 g of material.

7 PRECISION

Duplicate determinations shall not differ by more than the following:

Water Collected	Repeatability	Reproducibility
0 to 1.0 ml	0.1 ml	0.2 ml
1.1 to 25 ml	0.1 ml or 2 percent of the mean whichever is greater	0.2 ml or 10 percent of the mean whichever is greater

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Bitumen, Tar and Related Products Sectional Committee, PCD 06

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